

# **MILLING TOOL HOLDER WITH THREADED PLUG**

## **Cross-Reference to Related Application**

This application is a continuation-in-part of U.S. Patent Application Serial  
5 No. 10/693,418, filed October 27, 2003 for A MILLING TOOL HOLDER WITH  
DIFFERENTIAL SCREW.

## **Background and Summary of the Invention**

Tool holders for milling tools commonly employ a male tool-holding  
component having a frustoconical end, and a female driven shank having an  
10 opening for receiving the frustoconical end. Various ways are known in the art  
for tightly joining the shank to the tool holder.

My prior pending application disclosed a novel way for joining the tool  
holder and the shank together to prevent the tool from chattering from tool  
movement such as when used in a hydraulic tool system. My earlier invention  
15 prevents tool deflection, and avoids a poorly finished workpiece.

The broad purpose of the present invention is to provide an improved tool  
holder combination comprising an elongated tool holder having means at one  
end for supporting a milling tool, a frustoconical or tapered midsection and a  
slotted cylindrical end.

20 The shank has a frustoconical opening for receiving the tapered section of  
the tool holder, and an inner cylindrical cavity for receiving the cylindrical end of  
the tool holder.

A camming plug is inserted into the smooth cylindrical bore of the tool  
holder transverse to the turning axis of the tool holder. Both the tool holder and

the shank have aligned bores along the turning axis for receiving a draw screw. The plug has threads aligned with the turning axis of the tool holder. A draw screw is inserted in the bore of the shank and engages the plug threads in the tool holder. Turning the screw draws the tapered end of the tool holder into the frustoconical opening in the shank. The camming plug cams the tool to slightly enlarge the diameter of the tool holder in the shank opening to form a tight fitting connection between the tool holder and the shank.

Still further objects and advantages of the invention will become readily apparent to those skilled in the art to which the invention pertains upon reference to the following detailed description.

#### Description of the Drawings

The description refers to the accompanying drawings in which like reference characters refer to like parts throughout the several views, and in which:

FIGURE 1 illustrates a rotatable shank coupled to a tool holder and showing a tool for turning an internal draw screw for drawing the two components together;

FIGURE 2 is a longitudinal sectional view showing the tapered portion of the tool holder engaging the opening in the shank;

FIGURE 3 is an exploded view showing the tool holder, the draw screw, and the shank;

FIGURE 4 is a perspective view of the camming plug;

FIGURE 5 is a view showing the location of the camming plug in the tool holder opening;

FIGURE 6 is a view of a pin that prevents rotation of the tool holder;

FIGURE 7 is an enlarged section view of the camming plug enlarging the  
5 outside surface of the tool holder;

FIGURE 8 is an enlarged sectional view of another embodiment of the tool holder;

FIGURE 9 is a fragmentary perspective view of the camming plug and the tool holder;

10 FIGURE 10 is a fragmentary view of another embodiment of the invention;

FIGURE 11 illustrates a camming plug for the embodiment of Figure 10;  
and

FIGURE 12 is an enlarged sectional view as seen along lines 12-12 of Figure 10.

15 Description of the Preferred Embodiment

Referring to the drawings, Figure 1 illustrates a preferred tool holder combination 10 comprising a tool holder 12 joined to a shank 14. A milling tool 16 is carried, either integrally or by a suitable mounting on the outer end of the tool holder. An elongated hexagonal tool 18 is inserted inside the shank for  
20 purposes which will be described. The shank is driven by a rotating drive means, not shown.

Referring to Figures 2 and 3, tool holder 12 includes a body 20. The body has an integral frustoconical (tapered) midsection 22 with a large end terminating

in an annular seat 24. The narrow end of midsection 22 has an integral cylindrical neck 28. Neck 28 also has a pair of aligned axial slots 34 and 36, as best shown in Figure 5, and an internal smooth bore 30. In use the shank and the tool holder body are rotated about a turning axis 26.

5        The tool holder has a cylindrical plug-receiving opening 32 formed along an axis that is transverse to turning axis 26.

Referring to Figure 4, a cylindrical camming plug 38 is slidably receivable in plug-receiving opening 32. Plug 38 has an internal right-handed threaded opening 40 formed in such a manner that when the plug is inserted in plug-receiving opening 32, threaded opening 40 is aligned with turning axis 26 of the  
10 tool holder. Plug 38 has a length that is slightly less than the diameter of neck 28 so that neither end of the plug extends beyond the profile of the neck.

Referring to Figure 7, plug 38 has a diameter larger than the width of slots 34 and 36, and slightly less than the diameter of plug-receiving opening 32.

15        Plug-receiving opening 32 borders the inner ends of slots 34 and 36, forming a pair of concave camming surfaces 41a and 41b, which with slots 34 and 36 can slightly expand the diameter of both the neck and the narrow end of the tapered midsection. When plug 38 is axially moved toward the slots, the neck and the narrow end of midsection expand in the areas A and B, and the  
20 distance between opposite sides of the slots can be increased.

Referring to Figure 2, shank 14 has an outer diameter identical to that of body 20 of tool holder. One end of the shank has a female frustoconical opening

42 which terminates at its outer end with an annular seat 44 that mates in face-to-face contact with seat 24.

The narrow end of opening 42 terminates with a short cylindrical bore 36 which receives neck 28. The inner end of bore 46 terminates with end face 48.

5 Opening 42 is adapted to receive the frustoconical midsection of the tool holder in a position in which neck 28 enters bore 46 and seat 44 is in face-to-face contact with seat 24 of the tool holder.

The shank has a left-handed threaded bore 50 which extends along turning axis 26 and has an inner end opening into bore 46 and an outer end 52  
10 for receiving elongated hexagonal wrench 18.

An elongated draw screw 54 (differential screw) has a threaded end 56 threadably receivable in threaded opening 40 in camming plug 38. The opposite end 58 of the draw screw has an internal hexagonal opening 60 for mating with the inner end of tool 18 such that tool 18 can be used to turn the draw screw to  
15 urge the tool holder either toward or away from the shank. The draw screw also has a threaded section 62, receivable in threaded opening 50. Threaded end 56 and threaded section 62 have right and left hand threads, respectively.

Referring to Figure 6, tool holder 12 has a semi-cylindrical radial groove 64 in seat 24. The shank has a semi-cylindrical radial groove 66 in end face 44.  
20 A pin 68 is press fitted in a pin-receiving opening 70 formed when the two radial grooves are rotated to a face-to-face position, and drawn together. Pin 68 prevents any rotation of the shank with respect to the tool holder for work requiring a heavy cut. A lighter cut does not require pin 66.

In use, the user aligns the tool holder and the shank in the position illustrated in Figure 3. He inserts the draw screw through bore 46 until threaded end 56 engages threaded opening 40 of camming plug 38. He threadably engages the outer end of the draw screw with threaded bore 50. He then inserts  
5 tool 18 into the hexagonal bore 72 of the draw screw and turns the draw screw to pull the tool holder body into shank opening. He continues this motion until seat 24 of the tool holder and seat 44 of the shank are in face-to-face contact, and the plug expands neck 28 to tightly engage the cylindrical wall of bore 46 at B-B. The plug also expands the narrow end of the tapered midsection of the tool  
10 holder to tightly engage the tapered wall of the shank at A-A, adjacent slots 34 and 36.

Figure 8 illustrates another embodiment of the invention in which slots 34 and 36 are closed at lip 73. Neck 28 is still expanded by the camming plug in the shank opening as in the embodiment of Figure 7.

15 Figures 9-12 illustrate a modified embodiment 100 of the invention. In this case, shank 14 has a female frustoconical opening 42 for receiving the tapered midsection of body 12.

A smooth inner bore 104 in the shank has a pair of longitudinal grooves 106 and 108 on opposite sides of the base.

20 Camming plug 38c is slidably receivable in plug-receiving opening 32 and has a pair of integral keys 38a and 38b receivable, respectively, in grooves 106 and 108. This arrangement prevents the tool holder from being turned with respect to the shank. The plug has a threaded bore 40a adapted to receive the

threaded end 56 of the draw screw. The manner in which the tool holder is joined to the shank is the same as in the embodiment of Figure 3.

A cap screw (not shown) can be used in place of the differential screw by making bore 50 smooth with a larger diameter than that of the cap screw body.

- 5 The cap of the screw would have a larger diameter than bore 50, and bear against outer end 74 of the shank (see Figure 1).

Having described my invention, I claim: